

Policy Monitoring on Accessible Technology for Inclusive Education – Research Findings and Requirements for a Software Tool

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Abstract

Statistics about disabled people usually do not receive as much attention as statistics highlighting other socio-economic problems. However, such statistics is important due to its actual weight. According to the World Health Organization (WHO), about 15% of the world population, meaning one billion people, live with disabilities, and 80% of them live in developing countries. UNESCO claims that 90% of the children with disabilities in developing countries do not attend schools. Thus, it is of utmost relevance to raise awareness and strengthen public policies for the use of Assistive Technology (AT) to ensure Inclusive Education and Access to Information for people with disabilities, particularly in developing countries. Contributing to such efforts, this paper presents research findings on policy monitoring and evaluation tools and defines requirements for a software tool for monitoring a public policy for the use of AT to ensure Inclusive Education and Access to Information for persons with visual and hearing impairments, with particular focus on Uganda. The research findings and tool requirements presented in this paper could be adapted by other countries that pursue such policies.

Keywords: Accessible Technology, Inclusive Education, Policy Monitoring, Software Tools, Requirements

1. Introduction

According to the WHO¹, 15% of the world population, i.e. around one billion people, live with disabilities, and 80% of them live in developing countries. In the OECD (Organization for Economic Co-operation and Development) countries, women face higher incidents of disabilities than men. The World Bank² estimates that 20% of the world's poorest people have some kind of disability.

¹ <http://www.who.int/mediacentre/factsheets/fs352/en/>

² <http://www.worldbank.org/en/topic/disability/overview>

Statistics shows that poverty and disabilities are strongly related. On the one hand, poverty can increase the possibility of disability due to malnutrition, inadequate access to education and health care, unsafe working conditions, and lack of access to safe water and sanitation. On the other hand, disabilities may increase the risk of poverty due to the lack of employment and education opportunities, lower wages, and increased cost of living with disabilities. In addition to its correlation with poverty, disabilities also affect child education – 90% of the children with disabilities in developing countries do not attend any school [1].

Due to nature and severity of the problem, governments around the world are strengthening public policies for the use of AT to ensure inclusive education and access to information for disabled persons.

This paper introduces research findings on policy monitoring and evaluation tools, and presents requirements for a web-based tool for monitoring a public policy for the use of AT to ensure inclusive education and access to information for persons with visual and hearing impairments in Uganda. The presented findings can be adapted by any country that implements and monitors such policies.

The rest of the paper is structured as follows. Section 2 outlines the research methodology. Section 3 presents the literature review on policy tools and AT. Section 4 explains the UNESCO policy context. Section 5 outlines the data collection in Uganda to identify local requirements. Finally, Section 6 summarizes the elicited requirements, and Section 7 draws conclusions.

2. Research Methodology

The research methodology comprises six activities, as depicted in Figure 1 and explained below:

- 1) *Research on Policy Tools* – identifying existing web-based tools for monitoring and evaluating public policies, and synthesizing the findings by extracting relevant functionalities offered by

- carefully selected tools (presented in Section 3.1);
- 2) *Research on AT* – identifying resources on AT and selecting those appropriate for a policy monitoring and evaluation tool (discussed in Section 3.2);
 - 3) *Analysis of Policy Context* – identifying the UNESCO Model Policy guidelines for defining and monitoring a public policy on AT for Inclusive Education (outlined in Section 4);
 - 4) *Survey* – eliciting tool requirements considered important by local stakeholders through conducting a local survey in Uganda (explained in Section 5);
 - 5) *Identifying Requirements* – summarizing the emerging requirements from the previous four activities (presented in Section 6); and
 - 6) *Workshop* – presenting the outcomes of the previous activities to project partners and validating with against the requirements (discussed in Section 6).

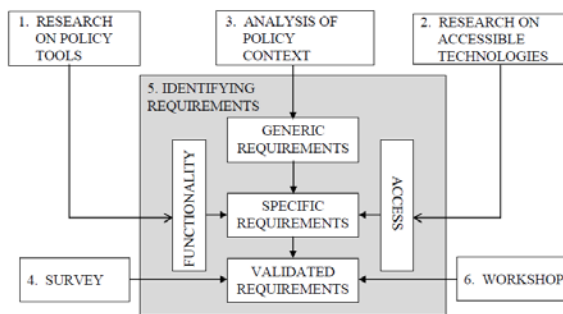


Fig.1 Research Methodology

3. Research Findings

This section presents findings from the literature review on policy tools (Section 3.1) and AT (Section 3.2). In both cases, the data collection process involved: 1) defining keywords for identifying relevant data sources; 2) searching policy-related resources on the Internet using the Google search; and 3) searching resources in a scientific database – Scopus. Data analyses was conducted using Mendeley, XMind and Excel tools.

3.1. Policy Tools

The keywords used for searching relevant documents both on Scopus and on the Internet were derived from the project's terms of reference. In particular, the keywords used for searching on the Internet were "*Web-Based Tools for Policy Evaluation*". The search was performed on 2 September 2015 and produced 17 results. The

expression used for searching the Scopus database was: ("*web-based tool*" AND ("*policy evaluation*" OR "*policy monitoring*")) AND ("*policy tool*" AND ("*policy evaluation*" OR "*policy monitoring*")). The search on the Scopus database was conducted on 7 September 2015 using article titles, abstracts, and keywords and produced 15 publications.

The obtained results are shown in Table 1.

In total, 34 functional properties were identified for policy monitoring and evaluation tools, grouped into six types of functionalities:

- 1) *Policy Monitoring* – controlling and evaluating the policy lifecycle, managing policies, programs and processes, and updating their status;
- 2) *Data Collection* – approaches used for gathering information useful for measuring policy indicators;
- 3) *Data Processing* – approaches that policy evaluation tools adopt for presenting results;
- 4) *Reporting* – producing reports to facilitate policy evaluation by showing how the policy achieves its objectives and impact. It also provides functions enabling to monitor the policy implementation process, and progress on outputs and outcomes;
- 5) *Policy Feedback* – refers to written advice produced for or by policymakers. It seeks to inform decision makers about policy options by providing detailed analysis of the options pursued in policy design and implementation;
- 6) *Capacity Building* – helps stakeholders developing their understanding of the policy tool, and their capacity for conducting or being involved in policy implementation processes. Furthermore, the functionality teaches different types of users how to use the policy tool.

Among the identified 34 functional properties, the most common is Participatory Survey with 10 occurrences, followed by Benchmarking and User Satisfaction Survey with 7 occurrences each, and Reporting on Policy Statistics with 6 occurrences.

3.2. Accessible Technologies

The keywords used for searching on the Internet and on Scopus were "*Web-Based*" and "*Accessible Technologies*". Conducted on 21 September 2015, the search on the Internet produced 17 results; the search on Scopus was executed on 22 September 2015 using article titles, abstracts and keywords, and produced three publications. The results are shown in Table 2.

Table 1. Literature Review – Related Work on Policy Tools

ID	SOURCE	TITLE/DESCRIPTION	REF
PT01	WWW	Web-Based tools for policy evaluation	[2]
PT02	WWW	Evaluation tools	[3]
PT03	WWW	Evaluation policy and evaluation practice	[4]
PT04	WWW	Public expenditure tracking surveys (PETS)	[5]
PT05	WWW	Quantitative service delivery surveys (QSDS)	[6]
PT06	WWW	Citizen report card	[7]
PT07	WWW	Community score card	[7]
PT08	WWW	Evaluating school turnaround	[8]
PT09	WWW	Design in European policy (DeEP) evaluation tool	[9]
PT10	WWW	Technology-enhanced assessment in education	[10]
PT11	WWW	Evaluating e-Learning - A guide to the evaluation of e-Learning	[11]
PT12	WWW	Evaluating the effectiveness of technology in our schools	[12]
PT13	WWW	Benchmarking e-Government	[13]
PT14	WWW	Common monitoring and evaluation framework	[14]
PT15	WWW	Monitoring, evaluation, reporting and improvement tool (MERI)	[15]
PT16	WWW	Ten steps to a results-based monitoring and evaluation system	[16]
PT17	WWW	United Nations Development Group (UNDG) Toolkit	[17]
PT18	Scopus	Evaluating the role of EPA policy levers: An examination of a voluntary program and regulatory threat in the metal-finishing industry	[18]
PT19	Scopus	Soviet control of city size	[19]
PT20	Scopus	Industrial development policies and performances in southern China: beyond the specialized industrial cluster program	[20]
PT21	Scopus	Theoretical and real effects of standardized assessment policies	[21]
PT22	Scopus	Attitudes toward policy instruments promoting wood-to-energy initiatives in the United States	[22]
PT23	Scopus	Rochester's lead law: evaluation of a local environmental health policy innovation	[23]
PT24	Scopus	Constraints and opportunities to forest policy implementation in Albania	[24]
PT25	Scopus	Input-output model for energy policy evaluation	[25]
PT26	Scopus	Government communication and democratic governance: electoral and policy-related information campaigns in Canada	[26]
PT27	Scopus	Web-based tools for policy evaluation	[2]
PT28	Scopus	How to evaluate rural policy if it aims to foster community involvement in environmental management?	[27]
PT29	Scopus	Innovation indicators and policy - some reflections on limitations and potentialities of innovation surveys	[28]
PT30	Scopus	Dynamic models for policy evaluation	[29]
PT31	Scopus	E-Government: towards electronic democracy, Proceed. of the International Conference, TCGOV 2005	[30]
PT32	Scopus	Subsidies for influenza vaccination, vaccination rates, and health outcomes among the elderly in Japan	[31]

Publications on web-based AT between 1999 and 2015 are scarce. However, in the last five years, research on web-based AT for people with disabilities increased more than three-fold. We identified 45 AT and classified them into: 1) *Accessibility Guidelines* – 8 resources or 18%; 2) *Accessibility Devices* – 13 resources, 29%; 3) *Accessible Tools* – 17 resources, 38%; and 4) *Accessibility Standards* – 7 resources, 15%. The most common resource is “Web accessibility guidelines” mentioned in five documents, followed by “Remediating inaccessible websites” and “Accessible website development” mentioned in three documents each. “Policies on web accessibility”, “Best practices community”, “Pointing devices”, “Keyboard overlay”, “Speech recognition”, “Braille display”, “Screen reader”, “Assistive technology”, “Websites examples” and “Accessibility policies in higher education” are mentioned in two documents each; while the others have only one reference.

4. Analysis of the Policy Context

The UNESCO Model Policy “Inclusive ICTs in Education for Persons with Disabilities” is one initiative led by UNESCO and the Global Initiative for Inclusive ICT (G3ICT). The objective is to facilitate the implementation of the United Nations Convention on Rights of Persons with Disabilities (UNCRPD), particularly, the Article 9 on Accessibility; the Article 21 on Freedom of Expression and Opinion, and Access to Information; and the Article 24 on Inclusive Education [55].

Inclusive ICTs in education refers to: 1) mainstreaming technologies available in the market with built-in accessibility features to provide equally effective access for learners with and without disabilities, e.g. browsers, office software, mobile phones, etc.; 2) assistive technologies that compensate for difficulties in accessing and using mainstream technologies, e.g. screen readers, alternative keyboards, etc.; 3) Compatibility between

mainstream and assistive and technologies; 4) Accessible media and formats, e.g. HTML, PDF, DAISY books, videos with captions, etc.; 5) Accessible digital learning content.

UNESCO’s long-term vision for inclusive ICTs in education is “... *inclusive ICTs are used effectively in education to enable all learners – in particular those with disabilities – to learn according to their individual learning preferences and to promote the long-term inclusion into wider society of learners with disabilities, particularly through enhancing their social inclusion and employment opportunities.*”

The UNESCO Model Policy [32] defines goals at three levels: 1) system level where “*Inclusive ICTs are seen as a tool to widen participation and increase educational opportunities and inclusion for learners with disabilities*”, 2) Organization Level where “*Educational organizations and all professional working with them are effectively supported to use inclusive ICTs to widen participation and increase learning opportunities*”; and 3) Learner Level where “*Inclusive ICTs are used as a tool for supporting participation in inclusive education and personalized learning opportunities*”.

Table 2. Literature Review – Related Work on Accessible Technologies

ID	SOURCE	TITLE/DESCRIPTION	REF
AT01	WWW	Accessible technology in the workspace	[33]
AT02	WWW	Web accessibility	[34]
AT03	WWW	Web content accessibility guidelines 1.0	[35]
AT04	WWW	Web content accessibility guidelines (WCAG) 2.0	[36]
AT05	WWW	Education & Outreach Working Group (EOWG)	[37]
AT06	WWW	Web Content Accessibility Guidelines Working Group (WCAG WG)	[38]
AT07	WWW	Accessible technology, do-it	[39]
AT08	WWW	University of Washington - Accessible technology	[40]
AT09	WWW	HSU Policy on web accessibility	[41]
AT10	WWW	Constructing accessible web sites	[42]
AT11	WWW	CSU accessible procurement process	[43]
AT12	WWW	How-to guide for creating accessible online learning content	[44]
AT13	WWW	California State University web accessibility	[45]
AT14	WWW	George Mason University web accessibility	[46]
AT15	WWW	Temple University accessible technology - accessible web site standards	[47]
AT16	WWW	Microsoft accessibility	[48]
AT17	WWW	Making web-based learning technologies accessible	[49]
AT18	SCOPUS	Supporting accessible technology-enhanced training: the e-access2learn framework	[50]
AT19	SCOPUS	Public engagement with biomedical research through location-sensitive technology	[51]
AT20	SCOPUS	New trends in ICT and accessibility, Proc. of the 1 st Int. Conf. in ICT and Accessibility, ICTA 2007	[52]

To accomplish the goals, the UNESCO Model Policy defines actions for four different stages: 1) *Auditing Actions* – reviewing the current situation; 2) *Prerequisite Actions* – ensuring that the necessary requirements are in place for the implementation; 3) *Implementation Actions* – delivering the policy objectives; and 4) *Monitoring and Dissemination Actions* – gathering feedback to guide further actions and to share information on results and outcomes.

In summary, the UNESCO Model Policy influences the design of a policy monitoring and evaluation tool at two levels. First, at the level of functionalities, where UNESCO explicitly defines the main functionalities of the monitoring mechanism for inclusive ICTs policies. In particular, UNESCO identifies four types of functionalities that a tool shall provide, which are aligned with the functionalities identified through research as described in Table 3. Second, at the level of indicators, where UNESCO defines the monitoring policy actions to consider for the monitoring process.

Table 3. Comparison of Tool Functionality

UNESCO Model Policy	Research Findings
Data Collection and Benchmarking	o Data Collection o Data Processing
Policy Monitoring and Promotion	o Policy Monitoring o Capacity-building
Identification of progress and problems	o Reporting
Identification of solutions	o Policy Feedback

5. Survey - Data Collection in Uganda

The data collection process in Uganda involved two main activities: 1) building an online questionnaire for collecting the stakeholders’ opinion about the tool functionality, and 2) conducting interviews for collecting local stakeholders’ opinions about possible usage scenarios of the tool.

The implementation of the online questionnaire relied on Google Forms. A pilot questionnaire was

conducted with an academic partner (Uganda Technology and Management University (UTAMU)); feedback was received and the questionnaire was improved based on it. 17 emails were sent to members of the Project Management Committee requesting to complete the questionnaire online. 4 persons completed the questionnaire by 12 December 2015.

An interview protocol was designed to gain an understanding of the benchmarking indicators, reporting information, mechanisms to provide policy feedback, feedback on policy impact, and other relevant comments provided by the interviewees. Nine members of the Committee were contacted by email on 1 December 2015 to request an interview, and five of them accepted. Among them, four answered the interview through a written document and one was interviewed through skype.

5.1. Questionnaire Results

According to the local stakeholders' opinions, the main goals of the tool are awareness and education, and stakeholder engagement (100% respondents). The second goal identified is documentation (75%).

Regarding tool beneficiaries, 100% of the respondents agreed that academic partners are the main beneficiaries. Other beneficiaries include international organizations, NGOs and government partners, with three responses (75%) each, followed by the public and private partners, with two responses each (50%).

All respondents agree that the most relevant source for collecting data comprises new instruments to be developed (100%). The majority of the respondents also identify NGO databases as important data sources (75%); while half of the respondents also consider government databases as possible data sources.

Concerning the frequency for collecting data, there was not too much agreement among stakeholders' opinions. Half of the respondents believe that data should be collected based on a pre-defined timeline, while 25% considers that data should be collected on an on-going basis, and another 25% selected other (unspecified) frequency.

Contrary to the lack of agreement on the frequency, all respondents indicated that participatory surveys conducted regularly is the preferred method for collecting data. Half of the respondents consider that user surveys conducted at the end of each policy action is also their preferred approach for data collection. Only 25% of respondent indicated that manual data entry processes are a suitable mechanism.

Regarding the type of information used to provide policy feedback, it was not possible to discern one type. Respondents selected as their preferred choice four out of the five alternatives – awareness raised by the policy action, ease and cost of use of the

policy action, number of disabled persons benefited by the policy action, and users' satisfaction about results of the policy action.

School authorities and teachers are the partners identified by all respondents as the most in need of awareness building; equally followed by government officials, NGOs' staff and the public, all of them selected by 75% of the respondents.

The analysis is inconclusive on the type of information most relevant for raising awareness among project stakeholders. Awareness on the importance of inclusive ICTs on education; on laws, regulations, and guidelines on inclusive ICTs in Education in Uganda; and on policies, programs and projects on inclusive ICTs in Education in Uganda were equally selected by 75% of the respondents.

The six open questions related to indicators aim at enabling respondents to propose indicators relevant for measuring: 1) disabled learners' participation; 2) disabled learners' achievements; 3) outcomes; 4) the use of inclusive ICTs in organizations 5) dialogue between stakeholders; and 6) transparency.

5.2. Interview Results

All five interviewees chose benchmarking as essential function. Example indicators recommended for benchmarking include: 1) number of students with disabilities utilizing or owning ICT devices; 2) number of schools/institutions using inclusive ICTs in teaching and learning; and 3) effectiveness of the available ICT.

The analysis is inconclusive regarding the type of information in which the tool shall report. Among the five interviewees, 40% indicated that the tool shall report on operational issues, other 40% on learning-related issues; while 20% on strategy-related issues. Example of information for reporting include: 1) lessons from other users in other countries; 2) case studies; and 3) sustainability strategies.

The policy feedback aspect explores the type of feedback that the experts can provide through the tool. Similar to the reporting information aspect, the analysis was inconclusive. 40% of the interviewees understood that experts can provide feedback on recommendations to improve the achievements of goals; other 40% believed that feedback should rely on example innovations to respond to the disabled persons' needs; while 20% on identifying problems and progress. Example information for policy feedback include: 1) lessons from other users in other countries; 2) raising resources to secure the relevant ICT; 3) sustainability of the ICT. The preferred mechanisms for collecting feedback on policy impact include satisfaction and dissatisfaction user surveys and online surveys.

6. Identified Requirements

The previous activities enabled us to define generic and specific requirements, as well as accessibility-related requirements for a web-based tool for

monitoring the implementation of a public policy on AT for Inclusive Education. During the workshop conducted in Uganda on 14 December 2015, requirements were validated and classified by project partners as mandatory and desirable. Table 4 shows the identified requirements.

Table 4. Identified Requirements for a Web-based Policy Monitoring Tool on AT for Inclusive Education

TYPE	ID	DESCRIPTION	MANDATORY	DESIRABLE
Generic	R1	The tool shall provide accessible information to persons with disabilities about mobility aids, devices and assistive technologies, including new technologies, and other forms of assistance, support services and facilities (<i>Ref: 2.1 Requirements of the UNCRPD</i>)	X	
	R2	The tool shall provide a knowledge repository of legislative instruments and policy documents that support the use of inclusive ICTs to support education (<i>Ref: 2.2 Requirement of national legislation</i>)	X	
	R3	The tool shall provide information to the public about the leading government ministry and its responsibilities (<i>Ref: 2.3 Lead Ministry</i>)	X	
	R4	The tool shall provide information about: 1) members of the standing advisory committee, 2) calendar of the committee activities, and 3) minutes of the activities (<i>Ref: 2.4 Policy Implementation Monitoring Mechanism</i>)		X
	R5	The tool shall provide information to the public about the Chief Accessibility Officer and its responsibilities (<i>Ref: 2.4 Policy Implementation Monitoring Mechanism</i>)	X	
	R6	The tool shall monitor policy objectives at three levels: 1) learner level, 2) organization level, and 3) system level (<i>Ref: Policy Objectives</i>)	X	
	R7	The tool shall provide support to policy actions at the four identified stages: 1) auditing action; 2) prerequisite actions; 3) implementation actions; and 4) monitoring and dissemination actions. The first two are considered desirable requirements, while the latter two mandatory. (<i>Ref: Policy Actions Linked to Phases of Policy Implementation</i>)	X	X
	R8	The tool shall provide a mechanism to store data related to the template for action plans (<i>Ref: 5.3 A Template for Action Plans</i>)	X	
Policy Monitoring	R9	The tool shall implement mechanisms for controlling the three principles guiding the inclusive ICTs in education policy, as prescribed by UNESCO Model	X	
	R10	The tool shall implement mechanisms for monitoring policy implementation	X	
Data Collection	R11	The tool shall implement a proactive approach for data collection	X	
	R12	Data shall be collected regularly by conducting participatory surveys	X	
	R13	Data shall be collected by through user surveys conducted at the end of the policy actions	X	
	R14	Data shall be collected by new instruments developed and implemented by the tool	X	
	R15	Data can be collected through governments and NGOs' databases		X
Data Processing	R16	The tool shall implement a benchmarking system of policy results	X	
	R17	The tool shall implement an alert system		X
	R18	The tool shall implement a tracking system; e.g. sustainability strategies, challenges, costs		X
Reporting	R19	The tool shall implement a mechanism for monitoring policy objectives at three levels: 1) learner level, 2) organization level and 3) system level	X	
	R20	The tool shall report evidence of policy benefits at the three identified level	X	
	R21	The tool shall report on efficiency – objectives and targets achieved	X	
	R22	The tool shall report on policy-related statistics – e.g. implementation of results and benefits, comparison of rural versus urban results	X	
	R23	The tool shall report on cost effectiveness		X
	R24	The tool shall document examples of impact	X	
	R25	The tool shall implement online surveys for assessing users' satisfaction and dissatisfaction	X	
	R26	The tool shall implement a mechanism to upload feedback received from interviews, multi-stakeholders workshops, group discussion, and field research	X	
Capacity-Building	R27	The tool shall implement a mechanism for documenting recommendations from government, academic and NGO's experts	X	
	R28	The tool shall provide a repository of good practices from other countries	X	
	R29	The tool shall provide guidelines for using the tool customized for each type of user	X	
	R30	The tool shall raise awareness about importance of inclusive ICTs in education (<i>related to R1</i>)	X	
	R31	The tool shall provide information about policy actions implemented in Uganda according to	X	

the UNESCO template (<i>linked to R2, and requirements of the national legislation</i>)			
	R32	The tool shall provide a repository of lessons learnt	X
	R33	Guidelines for using the tool shall consider customizations depending on the type of user	X
Accessibility	R34	The tool shall ensure that the text is readable and understandable	X
	R35	The tool shall provide text alternatives for non-text content	X
	R36	The tool shall include captions and other alternatives for multimedia files	X
	R37	The tool shall ensure that content is presented in different ways	X
	R38	The tool shall ensure that content is easier to see and hear	X
	R39	The tool shall ensure that content appears and operates in predictable ways	X
	R40	The tool shall ensure that the functionality is available from a keyboard	X
	R41	The tool shall ensure that users have enough time to read and use the content	X
	R42	Users shall be able to easily navigate, find content, and determine their location	X
	R43	The tool shall provide help for users to avoid and correct mistakes	X

7. Conclusions

The paper presented research findings of the state of the art in software tools for policy monitoring and evaluation and, in particular, it defined the requirements for a web-based tool for monitoring a public policy on the use of AT for inclusive education. Although the requirements were derived from an exercise conducted with the stakeholders in Uganda, the findings presented here could be adapted by any government willing to define and implement such policies. The main contributions of the paper include raising awareness about the need to strengthen government capacity on the use of AT to facilitate access to information and education for people with disabilities, and defining requirements for implementing a software tool for monitoring and evaluation of a public policy on the use of AT for inclusive education. The future work includes implementation and deployment of the first release of the tool in Uganda, in collaboration with UNESCO.

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